Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

DISCUSSIONS

THE VALUE OF METER TESTING BEFORE INSTALLATION

Two years ago it became necessary in this City, owing to the policy of metering each service which had been determined upon by the City Council, to devise ways and means for the testing of the measuring apparatus.

A standard meter testing outfit had been purchased by the writer's predecessor, but had never been used. While aware of the fact that meter companies do test each meter before it leaves the factory, it was thought expedient to perform our own tests. Our experience during the past eighteen months would justify the conclusion that the decision was correct. The expense involved in making tests is not a great one, and may be negligible, in our particular case, the work being performed by operators at the filter plant, who also attend to all meter repairs.

Our requirements for registration and capacity are virtually those specified in the Standard Specifications[1] for water meters recently adopted by this Association. Unfortunately the first lot of meters purchased gave us considerable trouble and annoyance due to lack of accuracy of registration within permissible limits on the fine stream, the proportion of rejects for this reason being 20 per cent. These meters had been stored in our shop six months and the manufacturer claimed that this feature coupled with an unsatisfactory water which they used for testing purposes was responsible for the lack of sensitiveness. At any rate, steps were immediately taken for making adjustments necessary, in which they were successful in large measure, only 15 per cent of the rejected batch being returned to the factory for replacement.

Later requirements of meters were purchased on rigid specifications, the percentage of rejects being negligible although apparently inexcusable defects such as sand holes, disk chamber slightly open, etc., were passed.

In view of the foregoing, we think it proper, and the expense justifiable, that each meter be tested for accuracy of registration before its installation. RICHARD F. WAGNER.[2]

---

[1] See JOURNAL, May, 1921, page 273.

[2] Superintendent and Engineer, Department of Water, Lynchburg, Va.

THE LOADING OF FILTER PLANTS[3]

Mr. Streeter's excellent paper on the loading of filter plants treats an important subject in a scientific manner. His scientific treatment is particularly gratifying, as in problems relating to filtration each phenomenon results from several causative factors, and it is very easy to draw erroneous conclusions as to cause and effect unless the statistical method is rigidly followed. There have been a number of instances in the recent past where this has not been done, and as a result false ideas have become current. It cannot be overemphasized that in these problems, which do not have the definiteness of typical problems in engineering or chemistry, the utmost caution must be used to avoid bias, and to this end the method of scientific statistics is an indispensable means.

If any comment may be made on the method of attack, it would be that the grouping adopted in table 1 is too broad. A more accurate, but more laborious way would have been to plot a point for each corresponding two values of raw and filtered water, and then determine the curve of best fit by the method of correlation.[4] A plot of all these points with such a curve or curves drawn through them would itself be of great interest. By proceeding in this manner it would also be possible to determine the coefficient of correlation, which would tell whether the correlation of the data were close enough to justify the formulation of a definite curve, or whether it were influenced by factors of which no account was taken. The same applies to table 4, the data of which might yield more definite results if treated as a problem in partial correlation. Such treatment would also give a means for estimating the accuracy of the results, as the probable errors could be found.

The question of Bact. coli results deserves special comment, particularly in view of the present practice of restricting the permissible Bact. coli in filtered supplies to very narrow limits. The relation between per cent positive tests and the number of bacteria causing same is not a simple arithmetic one. The writer has developed this relationship and has shown definitely that it is: $Q = e^{-x}$, where Q is the percentage of negative tests, and x the number of bacteria causing same. There are no assumptions in this relationship. It is absolute and the only correct one. If, of each sample, raw or filtered, a sufficient number of tubes are made to obtain directly a value of Q, then the number of Bact. coli can be computed from this formula. If the tests from which the per cent positive is derived extend over a period of time—week or month, the matter is complicated by the fact that the Bact. coli varied in some unknown manner during this time and the above formula cannot be applied directly. The writer has devised a method making use of the contrast between the 1 and 10 cc. tests which gives results of reasonable value in this case also. All this sounds rather complicated, but for working purposes has been incorporated by the writer into several diagrams which can be readily used by anyone without mathematical knowledge. Even with these aids to the correct interpretation of Bact. coli results, it must be remembered that these are on a much lower plane of accuracy than plate counts. A single plate gives a perfectly definite number of colonies which can be counted directly. Thirty plates give thirty perfectly definite numbers, which can be averaged to give a result of known accuracy. Thirty fermentation tubes give but one number—a percentage, subject to vagaries of interpretation which the above noted methods can only partially overcome. This then is the relative accuracy—thirty perfectly definite values vs. one partially definite value. This question needs careful consideration in connection with filter plant standards.

---

[3] JOURNAL, March, 1922, page 157.

[4] JOURNAL, September, 1918, page 272.

The fact that Mr. Streeter's results approximately confirm the permissible load factor of the International Joint Commission does not, to the writer, imply any extraordinary prescience on their part, nor is it of special significance. This load factor was formulated quite recently in point of relative time of filtration practice (1915, I believe) when many bacteriological data were available. Knowing that the Treasury standard of 2 Bact. coli per 100 cc. could be attained in the chlorinated effluent of filter plants, and that such plants could be operated with an overall efficiency of 99.6 per cent, simple multiplication gives a raw water load of 500 Bact. coli per 100 cc.

The writer's experience is that the reason that the bacterial efficiency increases with the raw water count is that the turbidity also increases, necessitating more coagulant, consequently better settling and filter efficiency. With clear but badly polluted waters it is very difficult to obtain satisfactory removal of bacteria even with large amounts of coagulants, and in such cases the usual permissible load does not apply.

In conclusion, it may be said that the solution of this important problem is in good hands. It is to be hoped that the United States Public Health Service will continue its investigations, carefully analyze the data obtained, and publish the data and conclusions so that they may be available for reference to all sanitary engineers.

MILTON F. STEIN.[5]

[5] Civil Engineer, Chicago, Ill.